DENGUE

HYGIENE & DISEASES

OF

WARM CLIMATES.

EDITED BY

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CHAPTER VIII.

DENGUE.

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Definition. — Dengue is a specific febrile disease peculiar to warm climates, characterised by severe articular and muscular pains, and, in most cases, by a primary and a terminal cutaneous eruption.

Synonyms.—Exanthesis rosalia; dandy fever, from the stiff dandified carriage of the sufferer; break-bone fever; broken-wing fever; bouquet fever; giraffe, from the stiffness of the neck; colorado; fièvre éruptive rhumatismale, etc. etc.

Etiology.—*Epidemic History.*—The earliest accounts which we have of this disease do not go farther back than 1779–80. The records of this outbreak are necessarily imperfect; for not only were the distinctive characters of the disease unknown to the physicians of that period, but the medical records from those tropical regions in which it must have prevailed were then extremely scanty. In the former of these years dengue is known to have been prevalent in Batavia and in Egypt, while in 1780 it was epidemic in Spain, Zanzibar, India (the Coromandel Coast), and probably also in Philadelphia, where a disease, which presented many of the characters of dengue, was observed by Rush, and described under the name of bilious remittent fever. If we remember that, although dengue had not at this time been recognised, the incidental descriptions of it which have come down to us indicate its existence in both hemispheres and in four continents, we may justly surmise that it had, at that period, assumed something like a pandemic extension.

Excepting a few limited outbreaks, notably one at Lima in 1818, little more is heard of dengue until the period 1824–28, when the next pandemy, which afforded an opportunity of studying its clinical and epidemic character, occurred. On this occasion it spread over a great part of the delta of the Ganges, extending inland as far as Berhampore; it also appeared at various points on the Coromandel Coast, and was observed at Gujerat in the west and Rangoon in the

east. It was widely prevalent from 1826–28 in the Southern States of the Union, in the West India Islands, and at some points, at least, of the South American continent (Carthagena and Bogota).

Dengue was now distinguished from other fevers, and, as a consequence, after this pandemy had subsided, we meet with numerous accounts of limited outbreaks in various regions. It was observed in Arabia in 1835; in India in 1836, 1844, 1847, and 1853–54; in Egypt in 1845; in Senegambia in 1845–48, 1856, and 1865–67; in Tahiti repeatedly from 1847–56; in Rio de Janeiro in 1845–49; in Callao and Lima in 1851; in Cayenne in 1864; in the Southern States of the Union in 1844, 1850, and 1854; in Havana in 1854, and in Martinique in 1860; in Bermuda in 1837, 1860, and 1863; in Spain and Teneriffe in 1865–67; Port Said in 1868; in Mauritius and Réunion in 1851.

The third pandemic extension of dengue began with its appearance in Zanzibar in 1870, where it seems, according to the recollections of the older inhabitants, to have raged during the former pandemic period (1824–28). From this point it spread to Aden, with which Zanzibar is commercially connected, and thence westwards along the Arabian coast to Port Said, and eastwards to India. From Bombay, Calcutta, and Madras, as centres, it spread along the lines of communication to most parts of the east and west coasts of the peninsula, and inland to the foot of the Himalayas. The epidemy did not rest confined to India, but extended to Burma, Siam, Cochin-China, Java, Celebes, Sumatra, and other islands of this region. It further appeared in 1873 in Mauritius and Réunion, where it was introduced by coolie immigrants from India, and the same year it broke out in some of the Southern States of the Union.

After the subsidence of this outbreak, dengue has only appeared in limited epidemies, such as that at Benghazi in Tripoli in 1878 (where it had already been observed in 1856); on the Gulf Coast of North America in 1880; in New Caledonia in 1884–85; in Fiji, for the first time, in 1885; at Port Said in 1885, and again in wide extension throughout Egypt in 1887. The summer of 1889 witnessed an extension of dengue to both shores of the Ægean and to most of the islands of the Archipelago excepting Crete. Beyrout and Jaffa were invaded in June, and somewhat later it broke out successively in Smyrna, Constantinople, and Salonika, reaching Athens towards the end of summer. It is said to have spread over the whole of Asia Minor and the Lebanon, visiting localities situated at elevations of 4000 and 5000 feet. At Smyrna it is calculated that 150,000 out of a population of 200,000 were attacked; at Jaffa very few escaped the malady.

Dengue is known to be endemic in certain countries. Dr. Sandwith, of Cairo, confirms, in a private communication, the statement of other observers, that dengue is met with in a sporadic form in Egypt every year during the damp months of autumn, and dies out in December. He remarks that in Egypt dengue is usually milder, and the rheumatic element less marked than elsewhere. Pruen has observed the disease in an endemic form in East Central Africa,[1] and ascribes it to the use of foul drinking-water. It is also noticed to occur sporadically from time to time in Senegambia, in Arabia, in some parts of India, in the Hawaiian Islands, and in Bermuda and Honduras.

A Disease of Warm Climates.—From this review of the principal epidemic outbreaks, and of the regions in which it appears to be endemic, it will be seen that dengue is eminently a disease of warm climates. Spain, Turkey, and Greece are the only European countries which have been visited by the disease. In America it has only once extended so far north as Philadelphia, and then it is stated to have died out in October when the cold weather set in. It is not only a disease of warm climates, but even in tropical countries epidemies of dengue usually attain their maximum during the warmest months of the year and decline or die out in the cold season. In the same way it is observed that the elevated and cooler regions of tropical countries are often spared, or at most suffer in a slight degree when the disease is prevalent on the warm coast plains. Thus, when dengue was raging at St. Denis in the island of Réunion in 1872, it did not propagate itself among the inhabitants of Salazie, a Spa situated in the hills at an elevation of 900 metres, although this place was in constant communication with St. Denis, and although the disease was actually introduced into it by visitors from the coast.

Dengue has often remained restricted to coast districts, and has shown but little tendency to invade the interior. This partial limitation to the coast line has been observed in Jamaica, Cuba, Brazil, and Peru, nor has the disease ever extended widely in the interior regions of the United States. This tendency of the disease to hug the shore may, in some cases, find its explanation in the lower temperature of elevated inlands being unfavourable to its spread, as in the instance of Salazie just referred to. That it is not necessarily restricted to coast regions, is evident from the fact that in India it spread in 1872–73 to the foot of the Himalayas, in lat. 34° N. Indeed, we have somewhat uncertain accounts of its having, towards the end of the last century, penetrated into Persia and Tibet. During the warm months of 1889 it broke out, as we have seen, in very high altitudes in Asia Minor.

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[1] Davidson's *Geographical Pathology*, vol. ii. p. 692.

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Relation to Weather.—The geographical distribution and seasonal prevalence of dengue indicate very clearly the influence of a high temperature in favouring its diffusion. Other meteorological conditions do not appear to be of much importance in relation to its prevalence. It has spread alike during the rainy and the dry seasons, and during calm and boisterous weather. The comparatively cold weather met with at certain seasons in tropical countries is insufficient to stop its progress, for it was during unusually damp and cool weather that it broke out in the West India Islands in 1827–28; but temperatures approaching the freezing point arrest its epidemic prevalence.

Soil and Locality.—The physical and geological characters of the soil appear to be without the slightest significance in respect to its sporadic or epidemic manifestations. Witness its outbreaks on the arid sands and rocks of India and in the flooded delta of the Ganges, on the volcanic soil of Mauritius and the alluvial plains of Senegambia. Low-lying and densely-crowded districts of cities are first and most severely affected when an epidemy occurs.

Mode of Spread.—Having once been introduced into a community, dengue usually spreads among the population with great rapidity. Dumarescq, referring to the outbreak of dengue in New Orleans in 1828, says: "Four persons were attacked by it at the same time, and its spread was so rapid among the inhabitants that, in eight or ten days, at least one-third of the population was labouring under its influence."[1] We would do well, however, not to take too literally such vague statements as that of Moreau de Jonnés, to the effect that one-half of the inhabitants of Havana were attacked by it *almost simultaneously.* It must, at the same time, be admitted that, in respect to rapidity of diffusion, dengue is exceeded by no disease except, perhaps, influenza.

Equally remarkable is the large proportion of the population attacked during an outbreak. In the epidemy which visited Mauritius in January and February 1873, it was estimated that two-thirds of the population was attacked. Perhaps this estimate was under the mark. It would appear that three-fourths of the inhabitants of Smyrna suffered in 1889, and the proportion was still higher at Jaffa. Stedman assures us that scarcely one out of the 12,000 inhabitants of the principal town of St. Thomas escaped.

Its period of epidemic prevalence in a particular locality is limited, seldom exceeding three or four months; but this depends a good deal upon the season of the year. Sporadic cases may occur for months or years after the epidemy has subsided.

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[1] Hirsch, *Handbook of Geo. and Hist. Path.* vol. i. p. 77.

The manner in which dengue is propagated has given rise to much discussion. Some have ascribed it to obscure meteorological conditions, or to earthquakes and volcanic agencies—a view which Corre appears to regard with some favour.[1] Others, and we think with better reason, ascribe it to contagion, or infection, or to both.

The rapidity with which it spreads among the inhabitants of a locality in which it has appeared has been urged as a conclusive argument against its diffusion by contagion; and it is certainly an argument not without weight. Hirsch justly remarks that "nothing tells so much against contagiousness as the sudden and simultaneous appearance of the disease over a great part of the population." But the question is: does dengue ever spread in this altogether sudden and simultaneous manner? We have good evidence to prove that the rapidity with which dengue spreads in a community is very great; but the facts in individual instances, when critically examined, do not appear to justify a strict interpretation of the term "simultaneous." If the disease, as we have reason to believe is the case, has a short incubatory period, it will not appear at all impossible on the theory of contagion that it should affect one-third of the population of a large city in the space of eight or ten days, as is stated to have been the case in New Orleans. As soon as it is clearly shown that one-half of the population of a city, such as Havana, can be simultaneously seized with dengue, all question of its spread in a particular community by contagion will be at an end. But the mode of its diffusion in a city, and that of its propagation from one place to another, are entirely distinct questions. It is perfectly conceivable that the germ of the disease may be transportable from place to place by means of human intercourse, and that, having once been introduced into a particular locality, it should grow and multiply in the soil or other surroundings, when these and the climatic conditions are favourable, and that it should thus be spread by infection as well as by contagion.

Whatever may be the manner in which it is diffused in localities into which it has been introduced, the evidence for its transportability from one region to another by human intercourse appears strong, if not altogether irresistible. A general survey of the progress of the epidemy of 1870—of its successive appearance in different places along the lines of communication—is strongly presumptive of its dissemination by human intercourse. But definite facts of its sudden outbreak in communities after the arrival of infected persons go far to convert this presumption into something like

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[1] *Maladies des Pays Chauds.* Paris, 1887.

certainty. A few examples only of this kind can be given here. Dickson affirms, and he had the means of knowing, that dengue was introduced into Charleston in 1828 by a vessel from Havana. The captain of the ship communicated the disease to his family, and its further transmission was traced from one person to another.[1]

The steam-ship *Dalhousie*, which arrived at Bombay in December 1871 with dengue on board, embarked European artillery for Cananore. The disease appeared among the Europeans while on board, and on their landing it broke out at Cananore and spread as far south as Cochin. Its outbreak at Trichinopoly, again, in 1872 followed upon the arrival of troops from Madras, where the disease was then prevalent.[2] It suddenly appeared at Mauritius and Réunion after the arrival of immigrants from infected districts in India.

Equally convincing are such instances as the following, which are recorded by Corre.[3] A government official had occasion to visit a locality 14 kilomètres from Tay-Ninh in Cochin-China where dengue was prevalent. Here he contracted the disease, and after his return home a colleague, with whom he lodged, became affected *within three days*, and he, in turn, communicated it to a European boy who attended him in his sickness.

The first case of dengue that occurred on board the *Andromaque*, in the harbour of Port Said, was in the person of the doctor who had visited patients suffering from it on shore. The disease afterwards spread among the men on board. The frequency with which medical men and nurses contract the disease is a matter of common observation.

Race, Age, Sex, etc.—No race enjoys an immunity from dengue, although some differences have been observed as regards their liability to contract the infection. The negro has been observed in some epidemics to escape more frequently than Europeans. This was the case, according to Stedman,[4] in St. Thomas; yet the three deaths ascribed to the disease in that island occurred in negroes. In Java in 1872, and at Benghazi in 1878, the negro race is said to have enjoyed a remarkable immunity; but it appears from the statement of Pasqua that in Egypt and Senegal negroes were as liable as others to contract the infection. In some outbreaks it has been observed that the natives of India have suffered to a larger extent than the Europeans. The Chinese at Amoy are stated to have suffered more frequently and severely than the European residents, while in Cochin-China the disease was more common among the Anamese than the

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[1] *Amer. Journ. Med. Sciences*, vol. iii. p. 3.

[2] Smart, "Epidem. Soc.," Feb. 13, 1877.

[3] *Loc. cit.*

[4] *Edin. Med. and Surg. Journ.* vol. xxx.

Chinese (Hirsch). How far these differences are to be explained by circumstances which involve a greater or lesser exposure to the infection, or to a greater power of resistance in certain races, we have no means of determining. The fact that the same race exhibits a varying degree of liability to the infection in different countries, seems to show that the liability is mainly determined by other circumstances than racial peculiarities.

The youngest ages are not exempt. Children a few days old have been attacked; and it has been stated that children have been born suffering from it. The disease seems in many instances to be specially severe in the aged, who often suffer from rheumatic pains and debility for months after the attack. In some epidemies pregnant women attacked with dengue have been little liable to abort, in other outbreaks abortions and miscarriages have been very frequent.

One attack of dengue usually confers an immunity from a second infection. Dickson, however, makes the interesting observation, that if the eruption proper to the second stage of the disease is absent, the patient is liable to have relapses.

Epizootic disorders are recorded to have coincided with epidemies of dengue at Cadiz in 1784, and at Baroda and Rangoon in 1872. Whether in these instances the animals suffered from dengue has not been determined.

Analogy points to the parasitic nature of dengue; but although several observers have found what they believed to be parasitic bodies in the blood of patients suffering from the disease, the specific agent of the infection has not hitherto been satisfactorily demonstrated.

Symptomatology.—The prominent symptoms of dengue are fever, pain, and cutaneous eruptions. Its clinical features, although remarkably variable, are generally distinctive. After a period of incubation, which may vary from a few hours to several days, the patient is suddenly seized with severe arthritic and muscular pains, headache and fever, accompanied by a cutaneous eruption, which is as varied in its type and seat as it is fugacious in its character. This may be described as the period of invasion or of primary fever. After the fever has lasted for one or two days a copious perspiration breaks out, which is followed by a remission of the fever, and an amelioration of the rheumatic symptoms, constituting what is called the period of remission, which generally lasts for two or three days. A second febrile movement now ensues, with more or less aggravation of the joint-pains, and a scarlet efflorescence, which generally appears on the palms of the hands and rapidly spreads over the body. This, which is the terminal, the most constant, and, indeed, the only

characteristic eruption of dengue, may disappear within the space of a few hours, or may persist for two or even three days. This is the eruptive stage of the disease. A fourth, or rheumatic, stage is frequently observed. A few days, or it may be one, two, or three weeks, or even longer, after the subsidence of the eruption, excruciating pains, not accompanied by fever, may recur in the fingers, toes, wrists, ankles, or knees. The fingers are not only painful, but are swollen, stiff, itchy, and extremely tender and sensitive. The pains in the joints are most severe in the morning, and become alleviated towards evening. Several joints may be thus affected simultaneously or in succession, and the attack may pass off in a few days or persist for one or two weeks. Relapses of these rheumatic symptoms are not uncommon, and we have known instances in which recurrences of joint-pains have been experienced for years at irregular intervals in persons who have suffered from dengue, and which appeared, indeed, to be in some sense a result of the disease.

A few points respecting the leading symptoms require brief notice.

Fever.—Premonitory symptoms are rare. Occasionally it happens that for a time, varying from three to twenty-four hours before the attack, the patient complains of lassitude, vertigo, a feeling of cold down the back, or of numbness of the extremities. Suddenness of accession is, however, a marked feature of the disease. In one instance, which illustrates the unexpected manner of attack, a gentleman went on board a vessel in the harbour of Port Louis, in perfect health, to pay a short visit, and had to be carried on shore suffering from fever and racked with pain. Rarely is the disease ushered in by distinct rigors; more frequently its onset is announced by slight chills; but these are often absent. In children, it is not rare for the disease to commence with convulsions.

The temperature in dengue fever rises rapidly, and attains its acme within twenty-four hours. Its usual course may be seen from the following observations by Vorderman:—

	First Case.			Second Case.	
	Morning.	Evening.		Morning.	Evening.
1st Day, . .	40°·8	41°·2	1st Day, . .	38°·0	40°·4
2nd ,, . .	38°·5	39°·0	2nd ,, . .	39°·0	39°·8
3rd ,, . .	37°·5	36°·7	3rd ,, . .	39°·4	38°·0
4th ,, . .	37°·2	37°·3	4th ,, . .	37°·8	37°·2

Dengue has occasionally been observed to present the febrile characters of ague, each accession being marked by a cold, hot, and sweating stage. During the fever, the patient sometimes complains of a feeling of intense cold. Dr. Stedman, who observed and

suffered from the disease in St. Thomas, informs us that he had to cover himself with three blankets, although the weather was at that time sultry. There is always great restlessness, and sometimes nausea and vomiting, with intense temporal and frontal headache, pain in the eyeballs and congestion of the conjunctivæ. The pulse is always fast and weak, and the respirations correspondingly accelerated.

When the fever falls the pains abate, but the patient remains languid, depressed, and restless.

The secondary fever may be absent, and when it is present it is very irregular in severity and duration.

Pain.—Pain, at some stage, is a constant symptom of dengue, and frequently it is one of the earliest, as it is one of the most persistent, symptoms. Its severity, however, differs greatly in particular outbreaks and individuals, as well as in the different stages of the malady. In the epidemy described by Stedman in St. Thomas,[1] the disease, we are told, generally announced itself by a sudden pain in one of the fingers—usually in one of the little fingers. The pains are generally at first located in the small joints, which may be swollen and tender as well as painful; but after a time the large articulations become affected, and the neck, back, and often, indeed, the whole body, is racked with pain. The pains, which, as we have said, abate with the remission of the fever, become accentuated during the eruptive stage, and may recur once or oftener after the disease in its febrile manifestations has long disappeared. This post-febrile rheumatic stage is often wanting. It should be noted that in the epidemic fever with scarlet eruption observed by Goodeve in Calcutta in 1853,[2] severe pain in the joints was seldom observed.

Eruptions. — An eruption during the primary stage is only met with in about two-thirds of the cases. It may present the appearance of an erythematous rash, of a miliary or papular eruption, or of a scarlet or rubeolar efflorescence. It usually lasts only for a few hours; sometimes it has been seen to disappear in half an hour, at other times it has been more persistent. The characteristic eruption, which follows the remission, appears about the fifth or sixth day of the disease; but in some cases even this eruption is absent, or is so fugitive as to escape detection. It generally takes the form of a scarlet rash, commencing on the palms and then spreading to the rest of the body. Occasionally it assumes the character of urticaria, the wheals being of a red colour on a scarlet ground. In the severer cases observed by Stedman, there were "swelling of the feet, hands, and eyelids, attended with distressing tingling, which, as the eruption disappeared, became an intense itching." This eruption is always

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[1] *Loc. cit.*

[2] *Indian Annals of Medical Science*, October 1853.

followed by desquamation, and occasionally by boils, carbuncles, abscesses, or ulcers.

The mucous membrane of the mouth seldom fails to become involved. In most cases it is reddened and aphthous. In the Calcutta epidemy described by Goodeve, to which we have already referred, the gums, the inside of the cheeks, the uvula, and the posterior third of the palate were of a bright red or vermilion colour. But in dengue the throat complications proper to malignant scarlet fever are never present.

When the eruption subsides, the patient is left in a state of great nervous prostration, and is more or less anæmic.

The Urine.—The following is Poggio's analysis of the urine in dengue, which is not without interest:[1]—

Constituent Elements. Proportion per 100.	Normal Urine.	Urine in Dengue.	
		During the Fever.	During the Eruption.
Urea, ...	3·00	2·920	2·925
Uric Acid, ...	0·10	0·104	0·100
Salts and Organic Matters, .	3·60	12·074	6·045
Water, ...	93·30	84·902	90·930

Digestion.—The tongue is coated; the patient often complains of nausea, anorexia, and colic. The bowels are constipated. In a few cases the skin becomes jaundiced.

Glandular Swellings.—During the period of remission, the glands of the groin, axilla, and neck frequently enlarge. This enlargement may pass off in a few days, or the glands may continue swollen and painful for a considerable time after the other symptoms have disappeared. The salivary glands are often enlarged and tender, and in some cases the patient suffers from troublesome salivation. Enlargement of the parotid frequently occurs; but suppuration, although it has been occasionally observed, is very rare.

Prognosis and Morbid Anatomy. — Dengue is never directly fatal, except in the case of old or otherwise worn-out subjects, in whom fatal syncope has in a few instances been observed. The few deaths that occur in patients suffering from dengue are the result of some anterior or intercurrent affection rather than of the disease itself. The prognosis is thus entirely favourable in every

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[1] Poggio, *La calentura roja observada en sus apariciones epid. de los años* 1865 y 1867. Madrid, 1871.

uncomplicated case of dengue, however distressing or even alarming may be the symptoms. The scanty post-mortem records of deaths from dengue throw no light whatever on the morbid anatomy of the disease.

Diagnosis.—The presence of the eruption and the course of the fever are sufficient to prevent dengue from being mistaken for rheumatic fever, while the rheumatic symptoms will prevent it from being confounded with any of the exanthemata, such as scarlet fever, measles, or roseola. Scarlet fever, the eruption of which is often closely simulated by that of dengue, is seldom seen, and never in extensive epidemies, in many of the tropical countries which have been most frequently and extensively visited by the latter.

In its wide distribution, its rapid diffusion, and in the numbers attacked, dengue is closely allied to influenza. But the clinical characters of the two diseases are entirely different, although in every epidemy of influenza cases occur in which rheumatic pains and a scarlet eruption so closely simulate dengue, that it will only be possible to avoid error by interpreting the symptoms in the light of the prevailing epidemy. Although influenza in exceptional instances may thus be mistaken for dengue, the latter seldom presents the characters of influenza.

Treatment.—As dengue is so little dangerous, treatment should be directed solely to the relief of urgent symptoms. Fever scarcely requires to be combated, for, although it runs high, it subsides rapidly and spontaneously. Some advantage may, however, be derived from antipyrin or salicin, not only in reducing the temperature, but in relieving the pain. Constipation should be obviated by mild laxatives; but it is well to remember that the articular pain is often so severe that frequent calls to stool occasion great distress, so that free purgation will only increase the sufferings of the patient. The pain, if not relieved by the use of the remedies suggested, may call for the administration of full doses of opium, which have proved exceedingly useful. The nervous depression which marks the eruptive stage demands the use of stimulants and restoratives, while the resulting debility and anæmia indicate the exhibition of quinine and iron, which are also the remedies most effective in preventing the relapses of arthritic pains.